THE

July, 1960

CHEMIST

VOLUME XXXVII

NUMBER 7

Dr. A. T. McPherson

Receives Honor Scroll of Washington AIC Chapter

(See page 275)

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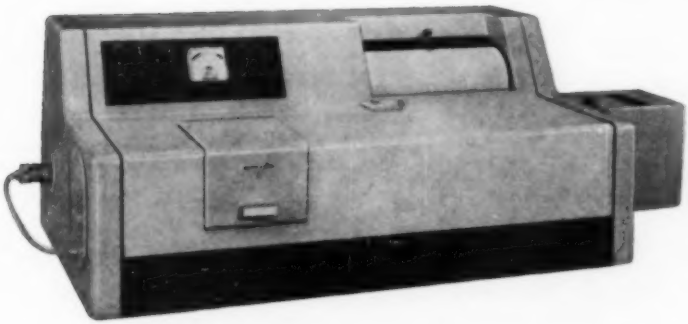

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Deadlines for THE CHEMIST: For the August issue the deadline is July 15.

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IN THIS ISSUE

TO COME IN AUGUST

Career opportunities and duties of chemists in public health agencies will be described in "The Chemist in Public Health," by Robert C. Stanfill, director of the Philadelphia District, Food & Drug Administration . . . Dr. C. G. Overberger, Polytechnic Institute of Brooklyn, who received the 1960 Honor Scroll of the New York Chapter, will present "The Purpose of Academic Research." The Annual Report of the Committee on Clinical Chemistry and other fine Committee reports will appear as space permits.

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A MESSAGE TO AIC MEMBERS

The Changing and Challenging Sixties

Dr. Wayne E. Kuhn, F.A.I.C.
Recent President of The American Institute of Chemists

(This presidential address, presented at the 37th Annual Meeting, May 13, 1960, is featured here for its fine five-point program, which if put into practice by each AIC member would improve professional status.)

WE are unquestionably living in changing and challenging times. We might well characterize the '60's as a technologically explosive era. The pace and rate of developments are tremendous. They have a very significant effect upon our profession, particularly on its future. There is a question whether the picture we observe of the current situation is as clear as it should be. Instead of looking at the exciting development that happened just today, this week, this month, there is need to look three, five, or twenty years into the future.

DR. WAYNE E. KUHN

We can envision many technical achievements. We AIC members, as a part of the scientific population of this country, have helped to create today's fast moving technology. During that time, we have made progress in improvement of prestige for our profession. We have made gains in many areas, but we cannot rest on this past progress. The real question we must ask ourselves is whether the profession of the chemist and the chemical engineer has kept and is keeping pace with the advances in technology. The challenge to us is to keep our professional status improving in the framework of the technical achievements we can visualize in the future.

Are we seeing correctly the impact of the potential technical advances of the '60's? Are we coupling this with the effect that it will have or could have on our profession? In 1923 some farsighted chemists were alert to some of the problems that might confront our profession. A group with this foresight conceived and organized the AIC. They could see the social changes that were in progress in those days; they could see the impact of the technology that we now consider old,

and they translated it in their way to see how it might affect our social and political systems.

They had foresight. But even they did not conceive of the many developments that have occurred in the decades which followed. All of this is within our lifetime. Our parents never dreamed of the social and political changes that have occurred since our childhood. Are we today as blind to potential changes as most of our parents and their contemporaries proved to be?

The era of improved transportation changed a pattern in this country. The development of a modern communication system was another advance that had an impact on our way of life. We are again at a turning point and will face changing and challenging times as a result of the developments of the past few years. If you wish, call it the electronic age, the space age, or the age of automaton. Regardless of your caption, these modern changes, piled one on another, are posing professional and social problems which need to be resolved.

In this technical world we are being challenged for survival by both economic and political forces that stem from within and without our nation. There are times when we are confronted with a confused picture of apparent splendor and technical achievements resulting from mass-directed effort. It has been said that the people of America will never buy socialism in one package, but they will buy social security, compulsory health insurance, federal aid to education, and similar things, one at a time—even socialized chemistry, unless we are alert.

Thus, today, we must meet several challenges. The one with which we are concerned in the AIC framework is that of the profession of the chemist and chemical engineer. We need to be concerned as to how this profession is recognized, respected and improved. In the inaugural address of Dr. Julius Adams Stratton, the 11th president of MIT, he stated what he believes constitutes a profession:

> "In the sense that I am speaking, all the professions share certain qualities in common that set them apart from the other occupations of men. Each, of course, is centered upon a particular field of learning. Each makes high demands upon the intellect and requires a mastery of special techniques. But it is an attitude that distinguishes the professions rather than their particular content. Above and beyond all technical competence the truly professional must be imbued with a sense of responsibility to employer and client, a high code of personal ethics, and a feeling of obligation to contribute to the public good."

I believe that you will agree that it is attitude that distinguishes the professions and it is attitude that results in appreciation and recognition of all professions. Accomplishments have resulted from the attitude of members of our professions. Recognition has come because of our attitudes as reflected in our conduct with the pub-

lic, through the expression of our convictions, and as an outward manifestation of our feelings.

To accomplish the task set before us we must allot more time and attention to the affairs of our profession. Too many of us are assuming the "too busy" attitude, or asking ourselves the question, "Who will do my job or my personal professional assignment if I allot more time or attention to the needs of our profession?"

If we do not work to keep our profession from being ruined by adverse criticism or legislation, we will find that there is no profession to worry about. There are too few professional men and groups who are alert to problems and trying to do something about them. To be effective we need good team work and more teams. We need to be sure we understand the problems. Then we need to act effectively in the right areas. We need a recognized, honorable, professional standing created by professional chemists and chemical engineers. We need a dynamic program attuned to the times.

Let me propose a five point program.

Think More Deeply . . .

(1) Think more deeply and analyze more carefully all professional problems. This is a must. Our profession typifies deep thinking and sound analysis. The true professional chemist and chemical engineer is continually seeking and questioning. Unfortunately, too often, too many speak first and think afterward on professional issues. They shoot without taking aim. In reality, they have done little real soul searching as to either motives or consequences. It is here that we need scientific thinking applied in a broad perspective manner—thinking that will result in the best interests of our profession as a whole and not for a narrow segment of it. Sole emphasis on narrow personal interests nearly always ends in alienating our professional associates.

Have you heard the story of state or federal control? The captions of the story might go something like this:

State (or federal) administration.
State (or federal) certification.
Promulgation of regulations.
Enforcement of regulations with penalties.

May I illustrate? More and more attention is being given to compulsory registration and licensing of technical individuals. Compulsory registration and licensing and personal freedom are incompatible. We must take the stand that you cannot deny qualified members of our profession the right to practice or the right to use their earned titles. This position does not overlook the fact that there is an area of public safety and public welfare that must receive attention from the standpoint of adequate public protection. This phase of work may require a form of licensing or registration for

those individuals carrying on efforts where public safety is involved.

There are numerous bills under consideration by various legislatures in the area of registration or licensing of professional individuals. As an illustration: In the recent meeting of the New York State Legislature, Senate Bill 2825, Assembly 2235, provided for the licensing of bio-analysts. As AIC president, I protested this bill to the chairman of the Senate Finance Committee, making this statement:

> "The bill contains a number of objectionable features and flaws. There is one in particular, however, to which The American Institute of Chemists is strongly opposed. This is paragraph 6852 which creates a State Board of Bio-Analyst Examiners all of whom 'shall be appointed from a list of eligible nominations to be furnished by the Board of Directors of the New York State Society of Bio-Analysts.' This Society is composed exclusively of owners and directors of bio-analytical laboratories. In other words, the bill will give this employer group a strangle-hold on the admission to practice of any applicant. Bio-analysts are required by the Act to be well-trained executives and experienced people 'qualified in any of the various branches of knowledge involved.' In other words, true professionals. It is obviously against public policy that their advancement may be halted by a small group of employers."

The bill was killed. I cite the above bill as an illustration of the thinking, not of an individual, but of a substantial group of people and their proposed encroachment on the personal freedom and the personal rights of trained professionals. This is not the only instance of an attempt to legislate the right and the opportunities of qualified members of a profession to practice. The enactment of regulations of this type invariably results in a contagious pattern that spreads to related professions and results in curtailment of professional practices. Think futuristically before you draw your conclusions.

In the national picture, there is a serious encroachment under consideration, namely the acquisition by the government of a large number of patents. In fact, the Federal government, even today, owns a larger number of patents than any other patent holder in the country. The government has decided that it will not exclude anyone from practicing an invention covered by a government-owned patent. Thus the use of a government-held patent provides no protection to the individual who was responsible for its conception and development. The AEC situation is often cited as a type of arrangement for *other* government agencies to follow. The atomic energy technology was originally developed with government funds, was a government monopoly from the start, and commercial utilization of inventions in the field was controlled.

But does this apply to industrial developments in other areas? Is it healthy and desirable to move away from free enterprise? As one of my government friends commented, "We believe in free enterprise but it should

be government-controlled free enterprise to minimize duplication."

There are many who believe it fruitless to object to the trend manifest in various government contract research activities. Condoning these practices without speaking up is silent approval and fosters further invasion into ethical professional practices covered by the AIC Code of Ethics.

Most of us in the AIC believe there is a balance between public interest and security, and equity. The big legislative argument today is whether government should (1) take title to inventions or patents arising out of work done under government contracts, or (2) merely acquire a royalty-free, non-exclusive, non-revocable license for government purposes. Further, if the government takes title, does it include staple items of commerce developed prior to receiving a government contract but used as a component part of a development? Again, government agencies are quoting Section 152 of the Atomic Energy Act of 1954 containing a patent clause which provides that the Commission will have ownership of all patent rights arising "in the course of, in connection with, or under the terms of the contract."

Mr. Roland T. Bryan, attorney, Patent Department of Babcock & Wilcox Co., commenting on this said:

> "To lawyers, these three terms each mean something different and the phrase 'in connection with' is extremely broad. In the interpretation by the AEC subject matter which lies in the same general technology, but does not have anything specifically to do with the contract, often is considered to have been developed 'in connection with' the AEC work.
>
> "Therefore, a patent applicant in this field is faced with having his invention taken away from him and to get it back he must prove that it was developed entirely separately from any AEC relationship."

The current thinking and apparent philosophy of the government to take entire right, title and interest in a patent, instead of acquiring a royalty-free, non-exclusive license, could have a very marked effect on our social and professional inventive climate of the future. One cannot increase incentive if one removes the right of the inventor from making or using his own invention. If we hope to maintain a satisfactory professional atmosphere and a free enterprise system on which our nation has grown strong and our living become good, we need to continue to maintain incentives, and the protection that was afforded under the patent system as originally devised.

Let us look at the Saylor Bill, HR 3375, which has passed the House. Sponsors say that Senate passage is assured. The bill is to provide for the expansion of coal research in the Department of the Interior. Sponsors of the bill point out that present research under the Bureau of Mines is long-range. The new bill, which would supplement the present activities, is for short-range research on

the utilization of coal under the Bureau of Mines.

All patented processes growing out of this work would be made available to the general public. As a start, $2-million will be authorized for the first year for this purpose. Developments under free enterprise in the coal industry will certainly emerge more slowly under the situation that will be created—another contagious pattern if allowed to spread to other free enterprise industries.

I urge that each of you think more deeply and analyze more carefully the road blocks that are being proposed and established today. We must be sensitive to the problems of the day and their impact on the future. One cannot deny that these professional problems will have a broad social impact with which we should be concerned. Think deeply on all these issues and let us place our mouths in gear with our brains and be sure that our utterances or endorsements are not a boomerang that will hit us in the back of the head.

Speak Up On Professional Issues

(2) Speak up on the vital professional issues. With positive and sound ideas there is need for the professional chemist and chemical engineer to make his position known. If his thinking is sound and he has a positive position to present, he can be persistent and persuasive. As a true professional he should face facts and his statements should not be what he thinks the individual wants to hear, but rather the unvarnished facts and the analysis of these facts in light of the future. Public sentiment is still a decisive factor when vital issues are at stake.

With forthright advice and guidance the public and the legislators respond. When the public responds the best laid plans of politicians can go on the siding. Today's public is very reasonable and it likes honest explanations. In fact, today's citizenry is smart so we don't want to try to kid it! It is essential that the professional speak up in connection with vital professional issues and everyone should make a private sale along these lines. You might even start with your next door neighbor. Don't put it off—put it over. Remember private opinion can create public opinion and public opinion will influence national behavior.

Take a More Active Part

(3) Play a more active part in professional affairs. As a member of, or associated with, our profession you should have a scientific insight that enables you to get to the core of the various professional problems. Your professional attitude is needed to help improve our professional climate. There is need for each one to be active in his local and national educational system, his local and national legislative bodies, and in his local and national professional groups. There is need to inject more professional

thinking into the various programs that are being prepared or proposed today. We need to assure that the rules and regulations that are adopted give the desired freedom as well as a measure of stability. We must not confuse stability with conformity. Conformity results in the elimination of individual identity. I urge that everyone play a more active part in professional affairs. Some individuals have latent talent but are lazy. They can be brought out of their lethargy by exposure and example. As a community becomes more aware of your sincerity, it will place more trust in your judgment and in following your guidance. So play a more active part in professional affairs. Professional improvement does not result from what you propose to do; *sometime*. Adopt a do-it-now kit. Remember, we will be compensated in the proportion we give.

Encourage the Younger Professionals

(4) Encourage our younger professionals to be more active. Our younger people have a tremendous stake in the future. They want professional careers that are honorable, to have prestige, and not to be hampered by unnecessary rules and regulations that would seriously and effectively curtail their professional advancement. They, who will be the future custodians of our profession, should have a sound and intelligently built foundation from which to work. These younger professionals must be given a clearer understanding of the many phases of our profession. They need to understand and thoroughly evaluate the consequences, if we forego our reliance on free enterprise and individual responsibility and initiative, in order to take the easy road of government legislation, subsidy and control. This latter road tends to penalties in personal freedom.

Today we believe that professionals must have the freedom that stimulates creativity and they must be permitted to operate under rules and regulations that permit creativity. Our social pressures must be geared to enable the able younger men in our profession to emerge as individuals in their profession and in their communities. Our younger scientists must accept their share of public leadership, if our profession is to progress and grow effectively in a free world. One cannot escape the professional responsibilities of tomorrow by evading them today.

Explain the Profession to the Public

(5) Explain our profession to the public. We must explain our activities to the public at all levels, management, laborers, union members, merchants, stockholders and our fellow workers. The AIC can be a most powerful instrument for inspiring, urging and informing the citizenry. This must be accepted as one of our responsibilities. Soviet progress has

aroused that nation's interest in scientific advancement. The Soviets are arousing the world. They have aroused their public to recognize the professional status of the scientist. We must take full advantage of this wave of interest and place our accomplishments and our position in the forefront in the free world. Explanations to each other are inadequate. Further, we cannot explain our profession to the public unless we are part of that public—an accepted part of it.

The challenge to us is to better publicize our work and to interpret it in better light in our national framework of existence. Based on some recent surveys, apparently the public believes that the gap between the humanities and social science and the physical sciences is widening and, in fact, is reaching alarming proportions. This means that each and every one of us must publicize technical accomplishments in the light of today's problems. We must emphasize positively and not in the framework of an alibi-ography.

In the conduct of good business we follow a practice of what we term preventive maintenance. This enables us to avoid expensive and costly repairs which result when equipment or procedures are not given due attention. Preventive maintenance includes a periodic replacement of worn parts. When an operation becomes obsolete we replace that operation with a modern version.

We need to apply continual preventive maintenance to our professional thinking. In this way we can keep our professional programs sound and we can discard crumbling ideas before they become obsolete. Even under this circumstance there is no guarantee that we can maintain our professional status unless each recognizes his professional responsibility.

The boundaries of professional responsibility are local, they are national, and in fact, they are global for those engaged in chemistry and chemical engineering. The motivation behind a group such as ours is invariably the result, the concern, and the activity of a small group. Our accomplishments are in part due to our ability to motivate additional members of our group. It is this effort of participation rather than structure of organization policy or codes that result in successful efforts.

It should not be a major concern, nor should we become too involved in how much or at what rate we improve the status of the chemist and the chemical engineer and his profession. Our responsibility is to keep the pressure for improvement strong, steady, and effective. We need to preserve our gains, we must maintain our role as a catalyst, we must continue our offense and we must accent the positive. Let us not be "against"; let us be "for." We must continually remember that one cannot effectively legislate status; it must be earned.

Special AIC Announcements

Policy on Compensation for Experience

The National Council, May 11, 1960, adopted the following policy, proposed in the report of the Committee on Ethics, on the subject of compensation for the experience accumulated by chemists and chemical engineers in pursuit of their profession:

> The AIC wishes to point out that our young chemists and chemical engineers are well paid upon graduation because a free market exists and the demand is great, but often our older, experienced chemists and chemical engineers, who are not executives, are not paid adequately because the market existing for them is quite limited. This is probably an important reason why scientists and engineers leave their profession as such and become "managers." With adequate compensation for scientific and technical experience, there will be much less loss of science talent to the needs of the country.

The Chicago Chapter Elects Officers

The Chicago Chapter has elected the following officers for the 1960-61 season:

Chairman, Dr. Austin B. Wilder, Petroleum Chemicals Div., E. I. du Pont de Nemours & Co., 8 So. Michigan Blvd., Chicago 3, Ill.
Chairman-elect, David W. Young, Sinclair Research Labs., 400 E. Sibley Blvd., Harvey, Ill.
Vice Chairman, Dr. Maxwell C. Brockmann, Quartermaster Food & Container Inst., 1819 W. Pershing Road, Chicago 9, Ill.
Secretary, Miss Helen Selin, 6916 N. Wayne Ave., Chicago 26, Ill.
Treasurer, Harry J. Pappas, The Griffith Labs., Inc., 1415 W. 37th St., Chicago 9, Ill.
National Council Representative, Bernard E. Schaar, M.R. Box 436, Chesterton, Indiana.
Chapter Councilors:
John A. King
Lawrence U. Berman

Nominations for Gold Medal Requested

The Gold Medal is awarded annually for "noteworthy and outstanding service to the science of chemistry or the profession of chemist or chemical engineer in the U. S." The Committee on Gold Medal Award, of which Dr. Henry B. Hass, former AIC president, is chairman, invites AIC members to suggest candidates for this award. Dr. Hass believes that "the more nominations we have, the less the chance of overlooking a worthy recipient." Please send suggestions to him, in care of the Sugar Research Foundation, Inc., 52 Wall St., New York 5, N. Y.

New Officers for Western Chapter

The Western Chapter has elected the following new officers:

Chairman, Stuart R. Garnett, 506 West Almond St., Compton 4, Calif.
Chairman-elect, John A. Kaasen, 1124 N. Mariposa Ave., Hollywood 29, Calif.
Vice-Chairman, Noel W. Lane, Jr., 405 No. 19th St., Montebello, Calif.
Executive Secretary, George H. Dye, 727 Divina Vista, Monterey Park, Calif.
Recording Secretary, Dr. Karol Mysels, 3938 S. Normandie Ave., Los Angeles 37, Calif.
Treasurer, Dr. Otto E. Lobstein, Chem-Tech Laboratories, Beverly Hills, Calif.

National Council Representative, George M. Cunningham, 3848 E. Colorado St., Pasadena 8, Calif.

Chapter Councilors:
Thomas J. Rollins, to 1963
Dr. Frederick G. Sawyer, to 1963
Truman Bewley, to 1961
Wilfred M. Noble, to 1961
Dr. Paul W. Jewel, to 1962
Dr. Ulrich B. Bray, to 1962

Washington Chapter Officers

The following officers will serve the Washington Chapter during 1960-61:

President, Dr. Clem O. Miller, National Academy of Science - NRC 2101 Constitution Ave., N.W., Washington 25, D.C.

Vice-president, Dr. Alexander P. Mathers, Alcohol & Tobacco Tax Laboratory, Internal Revenue Service, Washington, D.C.

Secretary, Dr. Anthony M. Schwartz, Harris Research Laboratories, 1246 Taylor St., N.W., Washington 11, D.C.

Treasurer, Robert C. Watson, Alcohol & Tobacco Tax Laboratory, Internal Revenue Service, Washington, D.C.

National Council Representative, Dr. Clem O. Miller.

New York Chapter Officers

The New York Chapter elected the following officers at its May meeting:

Chairman, Dr. John L. Hickson, Sugar Research Foundation, Inc., 52 Wall St., New York 5, N. Y.

Chairman-elect, Dr. Kurt S. Konigsbacher, Evans Research & Development Corp., 250 E. 43rd St., New York 17, N. Y.

Secretary, Dr. Robert E. Conary, Fishkill, N. Y.

Treasurer, Dr. Pauline Newman, Food Machinery & Chemical Corp., P.O. Box 8, Princeton, N. J.

National Council Representative, Dr. E. J. Durham, Nichols Labs., New York University, New York 53, N. Y.

Chapter Councilors:
William Barry
Dr. Murray Berdick
Karl M. Herstein

Professional Appointment

May 11-12, 1961. Washington, D. C. Statler Hotel, 38th Annual AIC Meeting. The Washington Chapter will be our Host.

The Chemist as a Bureaucratically-located Professional

Prof. Roy G. Francis

Professor of Sociology, University of Minnesota, Minneapolis, Minn.

(Presented at the Second Professional Session of the 37th Annual Meeting of THE AMERICAN INSTITUTE OF CHEMISTS, May 13, 1960, Minneapolis, Minn.)

ALTHOUGH we all speak the English language, if I am to communicate with you, I must spend some time developing basic ideas. Humanists are unhappy with sociologists for giving special meanings to otherwise commonly used words. But scientists know that each discipline must develop its own language, partly ridding itself thereby of the cumbersome and erroneous formulations of common sense.

PROF. ROY FRANCIS

This matter of language is of no small significance in what I want to talk about, for, in a sense, all social interaction is a matter of communication. Contrary to the expectations of most semanticists, words do not have meanings by themselves; nor does agreement as to meanings imply agreement as to courses of action. As the sociologist sees it, a proposed symbol takes on meaning—and thereby becomes a symbol—out of human behavior. Only if the (say) word suggests the same reaction to the listener as to the speaker is there real communication. A chemist may refer to something he calls H_2SO_4, and though I may agree that the referent is somehow a chemical, unless I know his way of reaction, we are not communicating at all. If I saw some stuff in a glass, and picked it up as though to drink it, and a chemist said, "H_2SO_4!" his communication would be more through his tone of voice than the content of his statement.

Hence, I must talk about some fundamental words—to "force" you to have the reaction I desire. Without this, we will not be communicating. Nor would it do for me merely to cite "Webster"; although this may satisfy those who respond to authority, it might not convey how I use the terms.

In short, since it takes a sociologist to talk to a sociologist, I must have a

brief excursion into fundamental sociological theory.

(1) Some Basic Concepts. Sociology is really not easy enough to fully train even intelligent people in fifteen minutes. But in that time limit, I should be able to convey enough to make later communication sensible.

(a) *The situation*: The initial abstraction of the sociologist is to limit the factors involved in accounting for human behavior. This is done primarily by considering the person (called the "actor") in a *situation*. This simply says that he is in a social setting where some action is going to take place. Any situation is characterized by an end or goal to be achieved, and means to obtain the end. When the people participating in the situation more or less agree as to what the goal is, the situation is defined. As the goal is more precisely known, the situation becomes more precisely defined.

When the situation is defined, the methods agreed, and the proper activities ascribed to the necessary actors, the situation is structured. A situation can lack structure, more or less, as the various components fail to have consensus. A completely unstructured situation would be one in which people unrelated to each other are assembled, with no presumption as to its definition or who is to do what.

It is apparent that considerable effort is frequently spent in defining a situation. Even if there may be a "cultural definition," the actors may achieve a contrary definition. When a political leader dies, a specific situation may be culturally defined as one of mourning and for the burial of the deceased. It may turn out to be defined as a struggle for power.

From an objective point of view, there are many alternative ways in which a situation can be defined. From the actor's point of view, however, there may be few if any alternatives. Moreover, there may be from the point of view of an observer, a variety of ways to "skin the cat." When this exists, we would say that the choice of the alternatives depends upon the *values* of the actors. When only one definition is perceived as possible, or when only one way of behaving is permitted, we would speak of the *mood* of the situation We will recur to this point later on.

(b) *The relation*. When a social act recurs, we will speak of a relation. The social act involves an actor whose behavior must take into account some other person (or persons). The recurrence of behavior implies a *relation;* and in a relation each has some reasonable expectation of the other. And there are many ways to characterize relations.

In terms of the *power* to compel the other to act as desired, we may think of *superordinate-subordinate* relations in contrast to *peer* relations. In all situations, there are various

ways to punish the other for failing to act as desired. In peer relations, gossip, frowning, ostracizing, etc., are effective controls. These are effective only if the other accepts them as punitive. The superordinate, however, is capable of direct infliction of punishment—as removing the subordinate from a job, etc., which, though the subordinate may deny it as punishment he must accept without counterclaims. Peers, however, have counterclaims.

Fundamentally there is a set of relationships more valuable to our discussion, since it encompasses all other patternings. There are several ways to distinguish between them; we will discuss two ways: The manner in which one enters the relationship, and the character of the demands that are placed on these in the relation.

(1) The Personal Relation. A relation which requires knowledge of the actors as *persons* is termed "personal." The idea of person conveys knowledge of the other far beyond the requirements of the immediate situation. As one knows another better, he learns of the other's aspirations, fears, hopes, doubts, joys and sorrows. When this knowledge counts, the relationship is personal. One enters this relation by exchanging names. The exchange of names is sometimes formal, sometimes the identification of the other grows from a "hey-you" to a nick-name. And, incidently, the nick-name is a necessary device to (a) distinguish degrees of closeness of relationship and (b) to more accurately characterize the other. That is, by calling a dignified University president by some pet name announces a relationship other than a formal one; and the idea of a "pet" name signifies something of a pet.

The calling of a person by a pet-name must be validated by at least the other (who must respond to the name), or by others who agree that the term is appropriate. If you called the president of your company "Charlie," and his name was something other than Charles, he might not respond as you would wish. Between the two of you, he must validate the name. Yet, the "nick-name" need not be validated by the person named. When Westbrook Pegler called Henry Wallace "Old Bubble-head," it was not necessary for Mr. Wallace to respond. All Pegler needed was a number (however small) of readers to accept this epithet as a correct designation.

The public rules for this sort of validation are not always present, especially in a crazy-mixed up urban world. We all know of the name-dropper. The name-dropper surreptitiously enters the personal relation with another; or, more accurately, claims a personal relation where none exists. The motivation for this type of lie is clear: Personal relations are prized relations. Knowing another

person's name is insufficient to establish a personal relation. The names must be exchanged; for it is in the transaction that the relation is established.

(2) THE CATEGORICAL RELATION. In a mass society, we enter far more categorical relations than any other kind. We could not possibly, or sensibly, enter personal relations with all the people whom it is possible to encounter during one's life in an urban world. In a rural world, yes; most relations are personal ones. Indeed, the process of urbanization implies the diminution of personal relations as controls over human behavior.

Members of categorical relations are, essentially, nameless. At least, if names are used, they do not refer to persons as people, but merely as ways to distinguish bodies from each other. Just as numbers can be used as names (in a sports roster, for example), in the categorical relation a name can be used as a number. Ordinarily, however, the mass is nameless. One enters it by surrendering one's identity, by relinquishing a name. This is exchanged only for the label of the mass.

We must, however, distinguish between three sub-types:

(a) *The impersonal.* Most of the time, when we meet people, we know reasonably well how to act towards them even if we do not know them as such. The situations we live in are quite structured, through customs and traditions, even if we are unaware of the structure. When we walk on the sidewalks of our cities, we continuously meet un-named others. Because they share our cultural experiences, the implicit definitions are accepted and we can anticipate their behavior reasonably well. We don't bump into them too frequently, nor do we stop and exchange pleasantries. A moment's reflection suggests that this relation characterizes the bulk of our daily contacts.

(b) *The stranger.* The relation characterized by strangeness is one where the parties belong to slightly different cultural patterns. One cannot correctly anticipate what the other will do in the given situation; he acts strangely. The error in predicting the behavior of the other is in addition to a lack of identification. As the error decreases, the strangeness lessens; and possibly, the personal relation emerges.

(c) *The foreigner.* If the behavior of the other is so different that communication is generally lacking, the people are foreigners to each other. As chemists, you are not likely to be in contact with these latter categories. Indeed, the "public" economically related to your employers will appear as "impersonal" relations to you. In a way, the most likely impersonal relation one will enter is that of a "public"; but for other than its indirect effects, in your professional

role you will scarcely be aware of the "public" at all.

(3) The Structural Relation. To be socially effective, which is virtually a redundancy, man today must organize. It is through his voluntary associations that man is capable of achieving his goals today. Whether these organizations are long-lasting or temporarily created for a specific task; whether they are small and large in terms of the number of people involved; man, today, organizes his fellow man for public action. In a way, we can argue that man's social inventions are at least as important as his technological ones in today's world. The organization of a productive process, of a sales force, of a market: These are the areas where success is given to the imaginative.

A structural relation involves people acting in terms of some position in a social organization. We enter them by exchanging our names for titles; and as title-holders specific things are expected of us. How one person is to behave towards another is more or less precisely stated. Sometimes the rules are rigidly enforced —as when diplomatic protocol requires specific behavior or the offended country takes official umbrage.

Not all behaviors are clearly one kind of relation or the other. Sometimes, there is a curious mixture. In a public address, an audience is customarily given both the title and name of the speaker; and two controls are invoked. "Dr. X, Professor of Sociology" not only puts one's professorship at stake, but his own personal reputation as well. Nor should we imagine that as one relation is weak, the other is strong. It is true that in most peasant societies, structural relations are weak and personal ones are strong; as a matter of fact, in peasant societies, most relations involve either named others or strangers. Many military outfits have strong structural and personal relations: nothing is more detailed than the tables of organization of a military unit; and with "esprit de corps," we have an instance of a well-knit personal organization.

(2) The Grammar of the Self. A social situation requires the existence of an actor and a real or imagined other. Before communication can take place in a real situation, however, the actor and the other must not only be "real," they must be known to each other. This means that some agreement as to who each other are must be reached. We must permit erroneous judgment of both the self and the other: We must permit the theoretical existence of a traitor. Indeed, the traitor presents himself as one thing and is accepted as such when, in fact, his interests are contrary to those asserted.

None the less, both must have some agreement as to the "characters" in the drama. Many people propose a self, and find that self rejected. The

adolescent may propose himself as an adult only to find his parents proposing him as a child. He may reject this proposal as much as the parents reject his. Lack of consensus destroys the possibility of effective communication.

In order to be effective, one's announced self must be accepted by others. This we call "validation" of the self.

The actor announces himself and *places* the other. When there is agreement, action can commence. But valuations are made. The actor has a value of himself, and decides upon some value to be assigned the other. Again, there may be a lack of consensus; and this can impede the action of the situation. Indeed, it may cause a severe re-definition of the situation: instead of acting in terms of the publicly agreed goal, a person may act to define himself. A case would be a person who senses he is considered a "poor risk" and then seeks to change the picture regarding his worth, quite independent of the "public purpose" of the meeting.

The procedure by which this is done involves human interaction. One's identity and worth are the results of social behavior.

(3) THE BUREAUCRACY. We should be prepared, now, to discuss the large-scale organization, the bureaucracy. Sociologically, the bureaucracy can be either public or privately owned; and, certainly, no value-judgment is involved. Privately, we may be irked by a bureaucrat; but we here wish only to discuss a particular kind of social arrangement. You will immediately recognize the company you work for.

The bureaucracy is characterized not only by its large size. It is highly organized, with clear distinction between "staff" and "line." Not infrequently, we find a fundamental conflict between "staff" and "line" officers, the latter often having preferred chances for promotion into positions of authority. The chemist is, usually, in a staff rather than line position. Along the line there is a clear division of authority *from the top down*. Each activity is carefully defined; the rules for behavior are clearly and centrally designated.

However, the bureaucracy, to insure the proper fulfillment of allocated activities, keeps records of activities. It does not make any difference whether the activity is the manufacture of an automobile part or whether it is an interview with an irate purchaser. Activities are recorded. There are numerous rules for the proper filling out of forms. And there are experts in form-filling who periodically examine forms for correctness. Not only that, but data contained on forms are summarized on other forms; and these summary forms have their own rules and their own experts; and, they, too, become summarized.

In many respects, a bureaucracy is a record-keeping organization. There are many advantages accruing to the bureaucratically organized group. The concept of "efficiency" flows largely from it: for with the record, analysis of activities is possible. With analysis comes not only standardization, but comparisons. Relative worth, relative costs can be systematically assessed: if the record can correspond to the activity.

Of course, the bureaucracy has a number of liabilities. The form may replace the act it is to represent. The form, being an instrument to achieve efficiency, is an end to the expert in form-filling. He may lose sight of the larger picture and be concerned with the form for its own sake. During World War II, for example, our organization was inspected prior to "overseas shipment." We were undergoing a specific training regimen; and were required to learn about gas warfare, wear masks, etc. If the outfit had not undergone the training no entry would be made in the service records of the men. Upon inspection, the *records* were then judged as being deficient. Instead of criticizing the command for not having required the training in question, the records were criticized for not having the proper entry. The solution to many seemed to be to make the entry whether the training was experienced or not. Thus it is with the extreme bureaucrat: the record replaces the action.

As we all know, however, these distortions are distortions; the purpose of the record is to maintain control over behavior. It implies a standard product, a standard activity. The professional finds it difficult to adjust to the record-keeping demands of the bureaucracy. Not because he is unable to keep records, but they seem to be so out of place.

The professional is a person who is enormously skilled in a particular area. He cannot be routinized. He refuses to be limited by the implications of a form and rebels against taking the time to complete them. But it is more than a rebellion against the time involved. It is a rebellion against the routinization.

The bureaucrat, typically, follows a single line of authority. He needs to have rules specifically ordering his behavior. He does not wish to make decisions. He prefers to have decisions made for him "by the rules." In diametric opposition, the professional wants to make decisions. He is an "authority" in his own right. He feels himself completely adequate to arrive at a decision. His profession sustains his self image, proscribes training, defines the requisite skills. The professional validation of self is personally more pleasing than a structural one. Incidently, one function of institutes of the sort you are now having is the validation of self, apart

from any bureaucratic claims. In any event, there is a real hiatus between the bureaucratic norm for efficiency and the professional norm of individuated decisions.

To make the discussion more specific, we will briefly discuss the sociology of science.

(4) The Sociology of Science. While the chemist, as chemist, can speak in a limited way about the sociologist, the sociologist can speak at length about the chemist. In our discipline, we have found it necessary to distinguish between "methodology" and "the sociology of science." "Methodology" adheres to a specific science and constitutes the rules of the game. While I am competent to discuss the methodology of sociology, I am not competent to discuss the methodology of chemistry. However, I can speak of the sociology of any science with complete confidence of my competence. For scientists are people behaving in typically human ways.

They constitute just one of a number of sub-cultures of interest. In a way, every scientist is an immigrant, moving from the broad culture of common sense into a specific one. Here he unlearns things from his general culture, if they conflict with science, and replaces them with new ones. The system of proof acceptable to the man in the street does not suffice in science; and so a period of training is required. During this period of training, the scientist not only learns new ideas, new behaviors, he develops a new identity. And with all identities, it must be validated by those who count. The most significant validation we have is the granting of an academic degree; and while the same signification can be otherwise achieved, the bestowal of a degree is an important announcement about the degree holder.

To avoid later confusion, I must distinguish between two uses of the word "scientific." One is "belonging to science"; and this will be my usual reference. The other is "science-like"; this is one reference most used by the man in the street although he does not make the distinction. He thinks medicine is scientific in the same sense chemistry is.

In general, the scientist is a decision-maker. He is to arrive at a decision regarding the acceptability of a particular statement about the world. He has at his disposal a "methodology" which constitutes his set of rules for arriving at the decision. It may be an experiment, or direct observation of on-going events. His situation is one in which the end is more or less clearly defined: decide upon the truth-value of proposed statement. The "mood" is that of doubt; and in a sense the goal is to remove the doubt.

There are a marvelous variety of instruments at his command. In some instances, few alternatives are present

for a proper test. In some situations, a variety of tests are immediately apparent. He has a problem to be solved, and the statement whose truth he is to judge is a proposed solution to his problem. If he accepts the statement as true, the problem is solved. If the statement is false, the problem is still unsolved.

But few scientists now do all of their work. They hire work done for them. There are those who make the observations and record them. There are those who do all the physical things that are necessary: put the apparatus together, handle the equipment and chemicals, and so on. These people are well trained. It is significant to note that they need not be able to think; all they need to do is to act. Many philosophers, in noting this, and mistaking the technician for the scientist (sometimes the scientist was his own technician) wrote arguments insisting that scientists do not have to think, that "scientific method" does it for them.

Stuff and nonsense! There are a host of decisions that must be made prior to the action requiring the work of the technician. First of all, a decision must be made that this particular statement is worth considering. Second, these statements don't create themselves; someone dreams them up. Neither of these are technical problems. They are theoretical problems. The scientist himself must be an imaginative, *creative* thinker.

Notice that one can not have a *logic* of creativity. For "logic" is simply the rules by which an inference is correctly reached from stated premises. Logic may assist in the test of an argument; but if the premises contain the "new" idea, which is required if logic is to be the rules for creativity, then they really were not new at all but hidden in the premises. Moreover, logic does not say which of all possible premises are to be considered. The scientist cannot rely only on rules. He needs them—and the right to think.

(5) THE CHEMIST AS A BUREAUCRATICALLY-LOCATED PROFESSIONAL. It is precisely at this point that the location of a chemist in a bureaucracy is of greatest significance. If the scientist could be equated with a technician, then the problem would not really exist. For the technician simply goes by rules—methodological, perhaps, but rules. He can fit into a bureaucratic scheme of things. He can carry on analysis as long as the formula (the rules) are given. But to create a new formula, this is another matter.

As a creative individual, the scientist cannot be bureaucratically controlled. The concept of "efficiency" is incorrect in respect to scientific discovery; although some ways for hypothesis testing are more efficient than others; and although deduction from existing theory is more efficient than mere random behavior; science itself

is not an efficient enterprise. Efficiency belongs to the world that is known. It does not belong to the world yet to be known. Efficiency is better hitched to the "past tense" than to the future tense.

Moreover, since there is no logic of creativity, one can not be ordered to be creative. I doubt if we must subscribe to any theory which assumes a fund of creativity which, when all gone, implies a shriveling of scientific competence. One cannot be told to be creative, any more than he can be told to "go catch a fish."

Yet this is precisely what "bureaucrats" often expect of the scientists employed in industry. They have been told, by public relations people, that "inventions can be ordered." New machines can be built via prescription as long as their underlying principles are known. New detergents can be invented via recipe as long as their underlying principles are known. This is not creativity; this is more application. This is engineering and may require some creativity of its own. Creativity involves the discovery of the principle to be utilized.

I know of a situation in which the scientist has developed a dodge that has, up to now, protected his job. You will recognize it immediately as an unfortunate ruse. Apparently, when he was first on the job, he was forever developing new ideas for research; and his staff pushed his activities along. But, as it frequently happens, creativity goes in fits and starts. A novel idea presents itself and while its implications are being worked out, a host of related ideas come into being. But when the lode is exhausted, a dormant period frequently follows; the mind is lying fallow, as it were. And this was the case with the man I know about.

During the hectic days of rapid discovery, his superior was elated. So elated that he could not anticipate the period of decline. The longer the decline, the more restive grew the bureaucrat and he began making not only demands but threatening noises. Eventually, of course, our hero developed some new ideas. This time, however, he had learned his lesson well. Instead of giving them all to his superior as they were developed, he hoarded some to "tide him over the lean times." He has been successful in his deception. And the bureaucrat is happy to know that almost anytime he wants a new idea, his man can give it to him.

But is this the sensible solution? Would it not be better if management were trained to accept the lean with the gravy, to better understand the creative process? Would it not be better if all parties better understood that the creative scientist can not fit neatly into a bureaucratic mold?

If this is the case, however, management has an important question to ask. Assuming that management has the right to discharge the inadequate,

what sort of rules are possible? Who can say when a real decline has set in? Who knows if a person's contributions are ended? At the moment, no one can. And the reason that no one can is that all tests up to now have begun with the assumption that creativity is a quantitative characteristic of individuals. However true that might be, the significant thing is to recognize the situational aspects of creativity.

The laboratory which is most conducive to creative activity is the one which involves scientists interacting with scientists. It is from one scientist that another draws his most important validation of self. However unfortunate is the man whose "wife doesn't understand him," consider the plight of the one whose boss doesn't either! For the lack of understanding is another way of saying "unable to validate my claims upon a social identity." The identity unvalidated exists in a vacuum. Not only nature, but man abhors the vacuum.

If management were aware of the need continuously to validate one's claims at scientific status, it would not be hesitant to let the major responsibility of deciding the worth of continued employment rest solely in the hands of the scientific group itself. For what management must ultimately have is loyalty—identification with the company. It is not merely validation of the claim "I am a chemist," but I am a "chemist for X company." The important thing is that loyalty is closely akin to the personal relation. It is a symmetrical thing; it works both ways. The loyal man knows that the other is capable of returning that loyalty.

To the extent to which this is true, management must allow its scientists to create their own structure. It cannot require that its creative staff work like its bureaucratic line; to do so is to destroy the creativity of its scientific staff. The usual rules of office procedure can not apply carte blanche to the world of scientific creativity. While some limits must exist, the best limits are those imposed by a group of sensible adults who are aware of their responsibility. Neither the license of anarchy nor the strait-jacket of bureaucracy, the professional chemist must, in a situation conducive to both creativity and plant loyalty, be free from the normal restraints found in traditional industry. If management fails to achieve this, the scientist will grab it—and probably through an existing mechanism which will validate their claims for the identity prized above bureaucratic location—creative scientist.

On Legislation

H.R. 12299, proposing legislative amendments to the Armed Forces Procurement Act, which appear to require bidding for professional engineering services, is opposed by the National Society of Professional Engineers, on the grounds that the proposed legislation might bring about conditions under which "Federal law would sanction a practice which is contrary to existing procedures and contrary to professional ethics which prohibit professional consulting engineers from bidding competitively for contracts involving the rendition of a professional service . . . The performance of engineering services is a highly specialized art, and the selection of the firm or individual to provide such services should be based solely upon qualification; price or fee is not and should not be taken into consideration during preliminary evaluation."

—From *News of the Engineering Profession*

"A Preview of Socialized Medicine"

The Forand Bill (H.R. 4700) would increase Social Security taxes (already scheduled to double during the next 10 years) to extend hospitalization, nursing home care, and surgical service to recipients of Social Security benefits. The Bill does not cover all those who need medical help, but only those over 65 now covered by Old Age and Survivors Insurance. Of the 15.7 million people over 65 today, 4 million are excluded under this bill since they are not eligible for social security; 7 million others are already covered under voluntary medical programs . . . The story of Federal control is this: Federal administration, certification of doctors, hospitals and nursing homes, fixing of fees and costs, promulgation of regulations, and enforcement with fines and jail sentences. These total socialized medicine without recourse . . .

—Condensed from *Spotlight*, No. J-430

H.R. 357 provides for federal aid to university extension programs in any academic field. Since pharmacy is included in this extension training program, the American Pharmaceutical Association and the American Association of Colleges of Pharmacy have testified in favor of the bill on grounds that "the health of the public would be better served through the continued education of the pharmacist . . ."

—From *Practical Pharmacy Ed., Journal A. Ph.A.*, April 1960.

"Under regulations issued by the Wage & Hour Administrator for employees in a bona fide professional capacity there is a requirement known as the 'salary test,' which presently states that professional employees must earn at least $95 per week."

—From *News of the Engineering Profession* (NSPE)

A bill introduced in Congress, May 18, by the Hon. John Sherman Cooper (R.Ky.) would regulate the use of living vertebrate animals in scientific experiments by requiring "Certificates of Compliance" from the Secretary of the Health, Education, and Welfare Department, before any Federal grant for scientific research could be secured. It has been referred for consideration to the AIC Committees on Legislation and on Clinical Chemistry.

Management and the Young Professional

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(A condensation of a paper presented before the Third Professional Session at the 37th Annual AIC Meeting, May 13, 1960, Minneapolis, Minn.)

WE have been hearing a great deal recently about the lack of professional status of the chemist. Industry certainly should expect its scientists to be professionals. A professional is one who is capable of rendering a highly specialized type of service. To be a true professional, a man must have had proper training and, above all, he must be growing intellectually, continuously.

There are many characteristics which are inherent in being a professional man and hence are indispensable in attaining professional status. I will touch on only the most important of these in pointing out what management expects of the young professional.

The hiring of technical people is a terrific gamble and there is no sure fire formula for success. The young professional often does not live up to the expectations on the basis of which he was hired. It is almost a total loss to all concerned, if after a few years, he must be released because he has not measured up to expectations.

What then does management look for and have a right to expect of the young professional? The following are some of the most important considerations.

(1) His academic training should be adequate.

(2) He should have a real desire to continue to learn.

(3) He should have an aptitude for industrial research.

(4) He should be aggressive and ambitious—a doer.

(5) He should have a creative imagination—be a dreamer.

(6) He should have good judgment, and a sense of balance.

(7) He should be accurate, and have capacity for detail.

(8) He should show leadership and organizing ability.

(9) He should be cooperative.

(10) He should be an optimist.

(11) He should have ability to communicate.

(12) He should be capable of growth to greater responsibilities.

Academic Training

The primary function of the academic training of the young professional is to lead him to acquire those characteristics which will fit him for a successful career in his profession. In colleges and universities which give advanced degrees emphasis on learning how to use the acquired information varies from school to school. It is unfortunate that in some schools there is a tendency for facts to be memorized in preparation for examination and then forgotten as the brain is washed in preparation for the facts that must be memorized in the next course. Frequent review and a good memory are necessary if the information one is exposed to during the training period is to contribute to success in research. Academic training should also place strong emphasis on how to do research. The graduate student who is only a pair of hands for the professor may never gain a real insight into the technique of tackling a research problem. It is highly important that academic training not only provide a knowledge of facts, but that it train the young professional to use the knowledge he has acquired in solving problems.

Total factual material is increasing at a rapid rate year by year. What is the solution to this problem? Will the Ph.D. of the future be a man who had gone to school until he is 35? Will the scientists of tomorrow be much more highly specialized than those of today? In training, what of the old can be left out to make room for the new? Can the rate of learning be accelerated? Because of the increasing amount of knowledge in the field of chemistry, will the time come when the professional chemist will be one with a Ph.D. and those with lesser training not be considered professionals?

Desire to Continue to Learn

The 9:00 to 4:00 research man does not wait until 65 for senility to begin; it can start at 25. It is said that only young men invent. On a statistical basis this may be so, but it need not be. An individual who continues to learn continues to grow. The young professional should continue to learn more about the workings of his company—its products and policies. He should strive to learn so he can be prepared for a better job. Looking ahead and preparing for the future can never be a waste of time . . .

Aptitude for Industrial Research

It can be assumed that at the Ph.D. level those without aptitude for research have been weeded out. However, some with research aptitude have traits which make them poorly suited for industrial research. It is not always easy to spot the man with poor aptitude without giving him a trial. In my experience, poor aptitude often reveals itself in a lack of enthusiasm for a problem the man has not

originated himself, and by the fact that his suggestions offer little promise of making a profit for the company.

However, conditions for research are not the same in all companies. Some companies depend largely on their research men to come up with ideas which will result in future business. In others, the general research program stems from a committee representing top management, sales, manufacturing, and research. In still others, research objectives are dictated by top management. A man with aptitude for research under one set of climatic conditions might be so unhappy under another that his superiors could easily confuse lack of research aptitude with unsatisfactory atmosphere.

Aggressiveness

Timid people believe that "nothing risked — nothing lost." Aggressive people, "nothing ventured — nothing gained." Aggressiveness is the motivating power that makes for a self-starter. One problem is to make sure the aggressive man gets started in the right direction. Otherwise, he may just drift faster than his less aggressive counterpart. The aggressive investigator hunts for ways to get around obstacles that obstruct his progress. For example, if the right piece of apparatus is not available, the timid soul will sit on his hands and moan. The aggressive one will concoct some alternative set up. An all-consuming desire to get the job done is an important quality.

Another form of aggressiveness is in connection with selling the results of research work. Too often the research man just grumbles when the results of what he considers successful research are not put to work. Sometimes a more careful evaluation would show that the research had really not been successful. In other cases the objective has been changed or the atmosphere varied, as happens when a competitor develops a better process while you have been solving the problem of a process of intermediate value. Sometimes, however, it is a lack of aggressiveness in convincing management that what you have done has merit. Do not try to sell the cats and dogs but be as aggressive as need be to put across your ideas on good projects.

Creativity

People with equivalent academic training are far from being equally creative. All of us in industrial research know that 90% of the profit-making ideas come from 20% of the technical men in our organizations. The Industrial Research Institute, through work at the University of Chicago, is trying to develop tests to measure creativity . . . Creative imagination means thinking beyond knowledge; inventive talents must be cultivated if they are to grow.

The opportunities are still great in the fields of chemistry and chemical engineering, but they are no longer the No. 1 glamour sciences which they were 40 years ago. The atomic bomb could not have been developed without the chemist and chemical engineer, but when the layman thinks of the bomb, he thinks first of other scientific disciplines. If we are to continue to get creative minds interested in chemistry and chemical engineering, we must put more emphasis on telling our story through science programs, etc., at the junior and high school levels.

Judgment

The trait of good judgment and sense of balance is the governor which controls the enthusiasm of both the doer and the dreamer. If enthusiasm warps judgment, the result may be expensive failure. In spite of heavy pressure and adverse circumstances, the man of judgment is able to maintain composure. Sound judgment is mainly the habit of sound and careful thinking, and it can be cultivated. The research man is expected to be part of management, and he must use his head to think commercially as well as theoretically.

One of the causes of frustration by technical people is when their judgment is not asked for by top management. A process may be licensed or a product bought and the first the research man knows of it is when he reads about it in the papers. Technical people have complained that any fly-by-night proposition can reach the ear of top management if it comes from the outside, but the best projects from the research department are only placed in the reserve file. If you feel that your judgment is not being used in your company, the best advice may be to resign, because in your opinion your company is probably not going anywhere—and you may be right.

Detail

Accuracy must be considered with capacity for detail because they go together. The research man is expected to furnish the perspiration to accompany the inspiration. In research, one cannot kid himself. The attributes of accuracy and capacity for detail are necessary—otherwise mistakes will be made which may even appear to others as deliberate dishonesty. Another attribute is to be a good housekeeper. It has often been observed that people with orderly minds tend to be orderly in other ways.

Another point in connection with accuracy deals with assumptions made in evaluating new processes. Competition is keen today and new or improved processes are continually replacing older ones. Mistakes in calculating yields, value of by-products, or operating costs can prove disastrous. The professional man must be accurate in all details of his work.

Leadership

A good leader will have the knack of improving the effectiveness of people working with him. A good leader is also a good organizer. He can be expected to get the job done efficiently and be capable of bringing a job to a successful conclusion. This is extremely important from the standpoint of management. Good leadership is a daily job and cannot be done on a spasmodic basis. Too often we see people who get fired up with enthusiasm but who lack the follow-up needed to get the job done. Leadership also means speaking out when you believe that mistakes are being made. Time and again research projects are unsuccessful because those doing the work honestly do not believe that it can be done. But they lack the courage or leadership to say so. The boss wants it done so they will work at it. Good leadership means leadership to success with a minimum of honest failures.

Cooperative

Most industrial research programs require the work of a team, rather than a lone wolf. Cooperation benefits each member of the group and should be practiced until it becomes a habit. There are always some who are rugged individuals to such an extent that they seem unable to fit into team projects of industrial research organizations.

Some people fail to cooperate because they feel that, if they do, the other fellow will eventually steal the credit if the project is successful. In general, when projects are really successful there is enough credit to go around. However, I am aware of instances where undue credit, both in universities and industries, has gone to one individual rather than to the group for the group effort.

Industry is frequently plagued with the problem where one individual is prolific in ideas which result in research programs and patents but some one else has to do about 99% of the work. The real professional man must recognize that his professional status depends upon progress and that progress often depends on cooperation.

Optimistic

Research work so often results in failures that one who is not a true optimist is likely to become discouraged. The Biblical phrase, "Seek and ye shall find," must be a key characteristic of the scientist. He will not always find what he seeks, but if truly observing, he will frequently discover something of value. If a new product does not have the properties being sought, it should not be thrown down the sink without further examination. It might well have novel properties that make it useful for some other purpose. Perhaps the main reason most inventions are made by younger men is that they have not lost their enthusiasm and curiosity . . . Consider the hundreds of new compounds synthesized each year and the very

small percentage of them that are ever put to practical use . . . the scientist must have real optimism if he is to be successful.

Communication

The young scientist in industry has to rely mostly on written communication to tell the story of what he has done and why it is important. If his work is to attract the attention of top management, he must write clearly and interestingly. There should be an air of enthusiasm in the written report, yet it must not contain false statements or half-truths. In conversation or conferences, he should be able to express himself clearly with a minimum of words.

The larger the organization with which the young professional is associated, the more difficult the problem of communication. In a small organization the president may come back into the laboratory and discuss your problems with you. In the large organizations sheer numbers often prevent the top management from ever meeting the young men. Social strata tend to develop and you communicate only at your own social status level and hope that, somehow, your ideas will reach a higher level. Many companies are giving serious thought to this problem of communications. I consider it to be a very important unsolved problem.

Growth Capability

The young scientist should be capable of growing to greater responsibilities within the company. In an organization when vacancies occur nearer the top, most managements prefer to fill these by advancing from within. However, there is no choice but to go outside the organization if the men within are not ready for advancement. The man whose characteristics are such that he shows little promise for further advancement is probably also lacking in the incentives needed to be a creative worker. There are exceptions. Some individuals grow materially in creativity even though they continue to work at the same level for years.

A few companies make it possible for top creative men to really advance financially and still remain at the laboratory bench, but they are few. We are going to see much more of this in the future, because I am sure that the companies with this policy are those with the greatest growth potential. Not all individuals want to grow in a company by changing from research to managerial activities, and if they are really creative in developing new products, transferring them from research is actually decreasing the chances of company progress. All of us get older every day. Whether we grow depends upon us as individuals. In general, growth in an organization takes the form of (1) higher specialization, (2) the management route, and (3) breadth of contacts.

In conclusion, there is one other

point to mention. Because learning in the field of specialization must never stop, this requires that the young professional participate actively in scientific and professional societies. He will also benefit by taking part in civic and social activities. He should attend meetings of professional societies at both the local and national level. This will give him opportunity to hear reports on the latest developments in his field and broaden both his professional outlook and his circle of acquaintances. Participation in civic and social activities is a matter of personal choice, but one can learn much about the behavior of people through such activities—and how one gets along with people plays an important part in the development of a successful professional career.

References

"Careers in Chemistry & Chemical Engineering," series in *Chemical & Engineering News*, July-December 1950; June 15, Oct. 5 and 11, 1954. (Has been reprinted in booklet form).

Research in Industry. Book. (1948) Edited by C. C. Furnas for Industrial Research Inst., D. Van Nostrand Co., Inc.

About AIC Members

Dr. Howard S. Turner, F.A.I.C., vice president, research and development, Jones & Laughlin Steel Corp., has been elected vice president and president-elect of Industrial Research Institute, Inc., 100 Park Ave., New York 17, N. Y.

Joseph K. Roberts, F.A.I.C., recently retired as director and vice president of Standard Oil Co. (Indiana), has been elected a director of Scientific Design Co., Inc., 2 Park Ave., New York 16, N. Y.

L. V. Clark, F.A.I.C., has been appointed director of explosives research and development for American Cyanamid Co., at the plant in New Castle, Pa. He joined Cyanamid in 1936.

Lawrence Flett, Hon. AIC, former AIC president, received the Honorary D.Sc. degree from the University of Buffalo, June 12. The introduction to the presentation mentioned that: "His steady absorption in his own enterprises never prevented him from encouraging young men to take their own initiatives."

Opportunities

Doris Eager, M.A.I.C.

Positions Available

Assistant Plant Manager. Responsible for direction, control & improvement of operating procedures, product costs, & direction of plant engineering and maintenance. Graduate chemical engineer, strong manufacturing background in industrial chemicals, well versed in inorganic chemistry and general engineering principles. Location midwest. Salary around $12,000. Box 71, THE CHEMIST.

Chemist (female). College graduate, experience in food field desirable, but June graduate considered. Also **Home Economist** (female). Home Economics, Textiles, or Chemistry major. Prefer experience in clothing and textile testing. Work in *Good Housekeeping* testing laboratory. Take typed resume. Hearst Magazines, Personnel Office, 309 West 56th St., N. Y. 19, N. Y.

Organic or Physical Organic Chemists (2) with 5 years or less of experience. Would consider M.S. degree but prefer Ph.D. Location Florida. Box 73, THE CHEMIST.

Chemists Available

Chemical Engineer, F.A.I.C. Successful record in planning research & development of marketable chemical products. Thoroughly familiar with sources of chemical equipment and products. Experience includes promotion, organization and management of new projects. Extensive acquaintance in chemical industry and with executive personnel. Highly qualified in selection of technical personnel. Box 70, THE CHEMIST.

Chemist. M.A.I.C. Several years experience in personnel, recruiting, and management search. Well-versed in modern analytical methods and in development of new drugs, cosmetics, feeds, etc. Desires a laboratory or semi-administrative position. Eastern U. S. Box 72, THE CHEMIST.

Dr. Louis Feinstein, F.A.I.C., formerly supervisory chemist, is now assistant chief, Field Crops and Animal Products Branch, Market Quality Research Division, USDA, Beltsville, Maryland.

Dr. Arthur E. Wood, F.A.I.C., head, Department of Chemistry, Mississippi State College, Clinton, Miss., received the Herty Medal, April 30, at Milledgeville, Ga. He was cited for "his distinguished work in the area of creative teaching." The medal is awarded annually on Herty Day by the Georgia State College for Women and the ACS Georgia Section.

Dr. J. V. N. Dorr, F.A.I.C., senior partner, Dorr Consultants, 99 Park Ave., New York, N. Y., recently received the Honorary D.Sc. degree from Polytechnic Institute of Brooklyn, N. Y.

The Spark of Originality

Dr. A. T. McPherson
Associate Director, National Bureau of Standards, Washington, D.C.

(Presented when the author received the Honor Award of the Washington AIC Chapter, May 24, 1960, Washington, D.C.)

THE spark of originality is innate in all human beings. Early manifestations in the form of the curiosity of small children necessarily lead to the curtailment of certain types of original action and initiative; and a little later regimentation by the school system all too often completely quenches the spark. The problem is not only to discover and fan the spark into action, but equally to direct and control the action so as to produce a sustained and continuing flame of interest in science, and not just a hasty and destructive conflagration.

It is one of the great privileges of a scientist to make discoveries of persons as well as discoveries of things in his field of specialization.

The Problem with Schools

A basic problem that is inherent in our present educational system is that the large number of pupils per teacher necessitates standardized curricula and mass production teaching methods. The fact that the instruction is necessarily designed for the average of the class need not stifle the expression of originality, if such expression is kept within socially acceptable limits, but all too often it does quench the spark.

Those who look nostalgically to the past need to be reminded that the little red schoolhouse often stifled original thinking to an even greater extent than schools today. I recall, personally, typical schools in the South of the early 1900's where the one-room school houses were not even red—they were not painted at all. The method of instruction was for the teacher to call a class to the front seats. The teacher's book would be open; the pupils' books would be closed. The teacher would ask a question; hands would be raised; fingers would be snapped—and the teacher would call on some pupil whose hand was waving violently. The pupil would stand to recite and, no matter what the answer, the pupil would invariably preface the answer by the words, "It said," meaning "The book said." The printed page was infallible, and it provided the complete and total sum of worthwhile knowledge of the subject.

In many schools and in many ways we have progressed far beyond this crude and primitive method of teaching. However, there are still circumstances which tend to frustrate and discourage rather than to stimulate the thoughtful student in his interest in science. Consider, for example, the stereotyped laboratory teaching which,

all too often, fails to become an adventure in learning and becomes an exercise in finding the expected result or, if the expected result is not found, recording it nevertheless, and thereby getting the maximum grade for the minimum effort.

The Role of the Professional Scientist

The subject of science teaching is receiving a great deal of attention throughout the nation. The National Science Foundation is supporting a research program that is already producing important results. Local educators and scientists are carrying on a number of projects in which many scientists are participating.

The schools are doing much for youth in science but with all that they are doing, they do not provide the whole environment of the young. The professional scientists can, and often do, provide an important part of the environment. They have a far larger responsibility for stimulating and training the future scientists that the nation needs than they may realize. I shall point out some of the specific things that professional scientists can do and are doing to kindle and encourage the spark of originality.

Exposition of Science for the Public

Books and other publications provide a far more significant and influential part of the environment of the young than one may suppose at first glance. Most young people, and certainly all gifted young people, read omnivorously. Thus, any well-written book or article in a periodical designed for the intelligent, non-technical reader will most certainly be read by the young. Every scientist who engages in original work has an obligation to present his findings to his professional colleagues—this is an obligation which he usually is glad to fulfill. He also has an obligation to present his major results to the scientific public outside of the field of his specialty. This is an obligation which he sometimes fulfills, though often grudgingly and under pressure. The third obligation—to present his work to the intelligent lay public is an obligation that some scientists of our community have fulfilled very well, while other scientists have disdained even to recognize an obligation.

A former member of the scientific community of Washington, to mention only one of many, has been conspicuously successful in presenting astro-physics in a way that appeals to secondary school pupils. The books by Gamov have stimulated countless young people to undertake careers of creative work in science, and often in fields that Gamov deals with only incidentally. A brilliant young mathematician was started on his career by a paperback edition of one of Gamov's books that he found in the corner drug store at a price within his allowance. This book mentioned

topology and this led him into the study of the whole field of mathematics.

Not all scientists can be gifted writers. But all can write, and they need to be reminded that the instrumentality of the printed page does not merely multiply their influence by a factor—it raises it by an exponent.

To make up for the shortcomings of some of our scientists in presenting their work to the public we have, in Washington in particular, a number of talented science writers who describe recent advances in science in a lucid and interesting manner.

Even with all of these avenues of communication it has been estimated that there is a lag of ten years between a significant scientific discovery and its complete acceptance by other workers in the field. Only after a generation is a discovery fully assimilated by scientists in general, and at least 100 years may be required before the discovery becomes integrated into general knowledge by the public. This large lag in our culture should be shortened so that our young people can have the inspiration that comes from a knowledge and understanding of what is happening on the frontiers of science.

Individual Contacts with Young Scientists

One of the greatest opportunities that young people enjoy in a scientific center, such as Washington, is the opportunity to meet and consult professional scientists. It may be worthwhile to indicate briefly what guidance the senior scientist may give and how it may be presented most helpfully.

Selection of a Project

The young people who seek out scientists seldom lack for ideas. Young people rarely ask someone to suggest a project. Their proposals, however, sometimes present difficulties. One difficulty is with the occasional youth who may not be deeply interested in science for its own sake, but wishes to conduct sensational experiments with explosions, pyrotechnics, rockets and the like. The scientist's obligation here is to determine whether the dangerous project should be carried out under adequately controlled conditions or whether a shift in interest should be tactfully brought about. In one instance a boy who was engaged in hazardous rocket experimentation was encouraged to go into high speed photography so as to measure the thrust and acceleration of some safely controlled rockets.

In advising about the selection of projects it is important not to underrate the capability and determination of gifted young people. This is illustrated by the junior high school lad who wrote to a scientific bureau of the Government asking for publications and information on electroluminescence. The reply stated that

electroluminescence was far too difficult a subject for a junior high school student to understand. This is undoubtedly true of junior high school pupils in general, but it was not true of this boy. Fortunately he was not discouraged but wrote to a large industrial firm and they replied giving full technical information to him as they would to any professional scientist. The end result was an outstanding project with an actual demonstration of electroluminescence.

Guide to the Literature

Few things that a professional scientist does for a young person are as productive of results and as deeply appreciated as introducing him to the literature on the subject of his interest. The usual school and public library sources on many recently developed fields of science are quite meagre and seldom up to date, so a visit to a scientific library is often a revelation. Arrangements to use the library after school hours can usually be made without difficulty, and a little assistance in locating pertinent periodicals and recent books may serve to open up a whole new world to an inquiring mind.

Design of Experiments and Construction of Apparatus

The "do-it-yourself" attitude is an almost invariable characteristic of the young persons gifted with a large measure of originality. They show great ingenuity in adapting materials at hand or within their means to the experiments that they wish to carry out. Unfortunately, the requirement in some schools that all pupils in science courses must participate in science fairs has resulted in considerable expenditures for elaborate and sophisticated equipment on the part of pupils or their parents who mistake gadgetry for scientific investigation. Only occasionally is a special piece of equipment costing $100 or more essential to the work of a young scientist. When such is demonstrably the case, interest and sponsorship by a friendly senior scientist in arranging for the loan of the equipment, or sponsoring the application for a grant for its purchase may enable a young person to engage in a serious piece of work and thereby mark the direction of his future career.

Presentation of Results

The serious minded junior scientist needs means of communicating his findings to his colleagues and the public just the same as the senior scientist. Science clubs provide one medium of communication; science fairs provide another. One of the most stimulating activities in this regard is the conduct of meetings of junior scientists at which papers are presented and discussed just as at professional society meetings. These meetings are most effectively planned and carried out by the junior scientists themselves, but they require a certain measure of inconspicuous but highly important guidance and support from

adults who keep discretely in the background.

Michael Faraday

The discovery and kindling of the spark of originality is in no case better illustrated than with Michael Faraday. His story is well known. He was a disappointment to his family because he was too frail to follow his father's trade as a blacksmith. Apprenticed to a bookbinder he entered the world of books. He must have read widely because a kindly customer, a Mr. Danse, was sufficiently impressed by casual conversations with the young apprentice to give him a ticket to a lecture by Sir Humphrey Davey, one of the great scientists of that day. Parenthetically, these early lectures for the public on science were followed by the celebrated Christmas Lectures for the young conducted by the Royal Society. These now find their counterpart in the Christmas Lectures of the Philosophical Society of Washington.

Mr. Danse came into the picture a second time when he encouraged young Faraday to send his lecture notes to Davey. Davey sent for Faraday and from then on Faraday's career was assured. You may think of the slender chain of circumstances by which one of the world's great scientists was discovered and started on his career as one dictated by chance. Instead of chance, however, it should be more properly termed serendipity. Serendipity is the circumstance under which one finds a thing of great value when he started out to look for something else.

Many—no one knows how many—potential Michael Faradays go undiscovered for the lack of a slight bit of encouragement at the right time. It is one of the great privileges of a scientist to make discoveries of persons as well as discoveries of things in his field of specialization.

Honor Presentation to Dr. McPherson

THE Honor Scroll of the Washington AIC Chapter was awarded to Dr. Archibald T. McPherson, associate director for engineering, National Bureau of Standards, Washington, D.C., May 24, 1960, at a dinner meeting held at the Army-Navy Club, preceded by a reception sponsored by the Fisher Scientific Company.

Dr. Wayne E. Kuhn, retiring AIC president, presented the Scroll to Dr. McPherson, who responded with an address, entitled, "The Spark of Originality." (See preceding pages.)

The guest speaker was Keith C. Johnson, supervising director of science of the District of Columbia Public Schools.

Dr. Clem O. Miller, chairman of

the Awards Committee, said that Dr. McPherson was selected in recognition of his unselfish devotion to the encouragement of young scientists and his significant contributions in the national interest through his leadership in the calibration and specification activities of the National Bureau of Standards.

Dr. McPherson was instrumental in getting the Washington Academy of Sciences to establish a committee for the encouragement of science talent in 1949. He was a member of the committee at its inception and was its chairman, 1952-56. He played an equally significant role in the founding of the Junior Academy of Sciences in 1952 and was chairman of its Governing Council, 1952-1956. In recognition of his contribution to it, he was elected a Fellow of the Junior Academy of Sciences. He has been active in the work of the Joint Board of Science Education since its establishment in 1955 and is currently one of the advisors to the National Science Foundation project on the teaching of science and mathematics in the schools of the Washington area.

Dr. McPherson was one of the pioneers in starting the area science fair program and in arranging intercity science tours for high school students. He is a participant in the summer institute program for high school teachers of American University. He was chairman of the subcommittee on specifications and a member of the main committee of seven who prepared the book, *Purchase Guide for Programs in Science, Mathematics, and Foreign Languages,* published in 1959 by the Council of Chief State Officers. By using this reference book, school officials have been able to save thousands of dollars of public money in purchasing school equipment.

Dr. McPherson's own researches have been in the field of organic chemistry, hydantoins; triazoles; mechanism of organic reactions; electrical, thermal, thermodynamic and optical constants, and properties of rubber. In 1959, he received the Gold Medal Award of the Department of Commerce for exceptional achievement in improving the effectiveness of the calibration and specification activities of the National Bureau of Standards and in support of the scientific and technological progress of the nation.

He is a native of Missouri, a graduate of Trinity College (A.B. 1914); University of Texas (M.A., 1916); and the University of Chicago (Ph.D., 1923).

Dr. R. L. Bateman, F.A.I.C., director — Market Development, Union Carbide Chemicals Co., New York 17, N. Y., recently said that the chemical industry's paramount challenge is to maintain the growth rate established during the past 14 years. It can be maintained if "the industry meets challenges in six key areas: raw materials, research and development, capacity and demand, foreign competition, technical manpower requirements, and market development."

David W. Young, F.A.I.C., research associate, Sinclair Research Labs., Inc., Harvey, Ill., whose hobby is the violin, including the materials used in the construction of old master violins, has spoken on "Antonio Stradivari, Artist and Chemist," before fifteen different audiences this year.

Dr. John A. King, F.A.I.C., director of research, Armour & Company, Chicago, Ill., has been invited by Agra University, Agra, India, to serve as an examiner of the doctoral thesis of Mr. S. N. Nigam, a candidate for the Ph.D. degree at the University, whose thesis is on the subject of synthetic tuberculostats.

Dr. Arthur R. Choppin, F.A.I.C., dean, College of Chemistry and Physics of Louisiana State University, Baton Rouge, La., recently received the Charles E. Coates Memorial Award in chemistry and chemical engineering, awarded annually by the ACS Baton Rouge Section and the American Institute of Chemical Engineers.

Dr. Roy S. Arrandale, F.A.I.C., vice president and technical director of Thatcher Glass Manufacturing Co., Inc., New York 22, N. Y. has been appointed to the advisory board of the Department of Chemical Engineering of the University of Rochester, Rochester, N. Y., for a three year term.

M. R. Bhagwat, F.A.I.C., retired June 1 from Hooker Chemical Corp., Niagara Falls, N. Y. He resides at 1839 Niagara Ave., Niagara Falls, N. Y.

R. J. Schoenenberger, F.A.I.C., has been appointed general manager of product sales and chemical products development, of Universal Oil Products Co., Des Plaines, Ill.